UTILITY PATENT APPLICATION TRANSMITTAL UNDER 37 CFR §1.53(b)

To: Assistant Commissioner for Patents
Box Patent Application
Washington, D.C. 20231, USA

Docket No.: 08-886705US

Inventor(s): Diaconescu,et al

The following are enclosed for filing this nonprovisional application relating to:

System and Method for Generation of Large Concatenated Payloads

☐ CONTINUING APPLICATION. This is a ☐ Continuation ☐ Divisional ☐ Continuation-in-part of prior Application No. _____

☐ A Certified Copy of the application(s) from which this application claims priority under 35 U.S.C. §119 has been filed in the prior application identified above.

☐ Copy of the assignment(s) to , recorded with respect to the prior application identified above.

ev ok to Accept

☒ Specification, including Claims and Abstract Pages: 10

☒ Drawings Sheets: 3

☒ Oath or Declaration Pages: 3

☒ New

or ☐ Copy from the prior application identified above (for cont./div., 37 CFR §1.63(d))

☐ Signed statement attached deleting inventor(s) named in the prior application

☐ The entire disclosure of the prior application is considered as being part of the disclosure of the accompanying application and is hereby incorporated therein by reference.

☐ Certified Copy of Priority Document (if foreign priority is claimed)

☒ Assignment Papers (cover sheets(s) and documents(s)). Please record and return to the undersigned.

☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations

☐ Preliminary Amendment. Fees are calculated below after entry of any preliminary amendment.

☒ Return Receipt Postcard

☐ Other:

FEES:			
	Basic Fee:		$690.00
	Assignment(s):	____ x $40.00 =	
	☐ Multiple Dependent Claims		
	Total Claims:	5 - 20 = ____ x $18.00 =	
	Independent Claims:	3 - 3 = ____ x $78.00 =	
		TOTAL FEE:	$690.00

The Assistant Commissioner is hereby authorized to charge the following fees, and to charge any additional fees which may be required or credit any overpayment to **Deposit Account No. 07-1750.**

☒ Fees required under 37 CFR §1.116 including the Total Fee calculated above.

☐ Fees required under 37 CFR §1.117 (Patent Application Processing Fees).

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Yours very truly

By: John Harris
Patent Agent
Registration No. 39,465

Date: September 20, 2000

SYSTEM AND METHOD FOR GENERATION OF LARGE CONCATENATED PAYLOADS

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is related to co-pending and co-assigned United States Patent Application no._____"Pointer Processing and Path BIP-8 Computation for Large Concatenated Payloads", filed on September 15, 2000.

MICROFICHE APPENDIX

Not applicable.

TECHNICAL FIELD

The present invention relates to optical communication networks, and in particular to data generation of large concatenated payloads within processing nodes of such a network.

BACKGROUND OF THE INVENTION

In optical networks today, processing nodes of the networks are designed for processing various types of data frames. During the design of such processing nodes, the designed systems are tested by generating and sending through these nodes test frames. In particular, data frames comprising concatenated payloads, such as frames based on the SONET or SDH standards, are commonly used for transmitting information across such networks and accordingly, the generation of similarly structured test frames is required.

A system generating data in various frame formats will be referred herein as a data generator. The present invention considers data generators comprising one or more processing strips. Each processing strip is capable of generating a data slice of a given size. In the case when a data generator comprises more processing strips, the data slices generated by the strips are collected together in the data frame to be generated. The size of the data frame

thus generated is directed to the number of data slices collected, therefore the capacity of the data generator is given by the number of processing strips it has.

Data frames comprising large concatenated payloads such as the SONET/SDH type frames may be formed by pasting together several smaller size data slices. Therefore, the generation of such frames requires the use of a data generator with enough processing strips to account merely for the size of these frames. This requirement is easily overcome by known data generators, which may be designed to the required size by including enough processing strips. A more difficult requirement to meet arises from the concatenation feature of such frames. Collecting several data slices into a concatenated frame implies synchronization of all the processing strips contributing data slices to the concatenated frames, synchronization which must take place during the generation of the actual data slices. For example, in the case of SONET/SDH type frames, the synchronization implies acknowledging the correct pointer information at all contributing strips. In addition, various overhead bytes such as the B3 byte for SONET /SDH type frames of the concatenated frame are generated only in some data slices making up the final frame, but their value is dependent on the data generated on other slices.

Similar synchronization issues are described for example in co-pending and co-assigned Application no._____"Pointer Processing and Path BIP-8 Computation for Large Concatenated Payloads", filed on September 15, 2000, with respect to pointer processing machines structured on arrays of parallel pointer processing strips. In the described pointer processing machines, the synchronization issues are solved by establishing a bi-directional flow of data along the contributing pointer processing strips. However, such a bi-directional data flow along the pointer processing strips requires a complex design, with a large hardware overhead. For example, communicating B3 byte data only from a strip to an adjacent strip requires 9 communication pins on each strip, where 8 of these pins are for the actual B3 byte value and an extra pin is used to send a concatenation signal among the two strips.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a novel system and method for generating large concatenated payloads within a processing node of an optical communications network.

According to one aspect of the invention there is provided a method for generating a data slice of a SONET/SDH type data frame, wherein the data slice has a plurality of STS-1 blocks. For each STS-1 block within the data slice, the method comprises reading a pointer state indication and, whenever the pointer state indication has a concatenation indication, generating payload bytes of the STS-1 block such that the B3 byte of the STS-1 block assumes a predetermined B3 fixed value. According to the preferred embodiment, the payload for each concatenated STS-1 block within a data slice in a large concatenation mode is generated such that B3 =0.

According to another aspect of the invention there is provided a method for generating a SONET/SDH frame. The method comprises initiating a set of programmable register values with frame parameters, generating data slices comprising a plurality of STS-1 blocks based on said frame parameters, and collecting the data slices to generate a frame. Whenever a large concatenation mode within said frame parameters assumes an ON state, the data slice generation includes, setting the pointer value to a predetermined fixed pointer value and generating payload bytes of every STS-1 block having a concatenation indication such that the B3 byte of the STS-1 block assumes a predetermined fixed B3 value.

According to another aspect of the invention there is provided a data generator for generating SONET/SDH type data frames. The data generator comprises a plurality of processing strips for generating a plurality of associated data slices having STS-1 blocks. Each strip may operate in a large concatenation mode in which a fixed pointer value and a fixed B3 value is assumed for each STS-1 block within the data slice. A data collection block of the data generator collects generated data slices into a data frame.

Among the advantages presented by the method and system of the preferred embodiments of the invention is the ability to generate arbitrary large concatenated payloads, without

communication between processing strips of data generators. Other advantages, objects, and features of the present invention will be readily apparent to those skilled in the art from a review of the following detailed description of preferred embodiments in conjunction with the accompanying drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be explained, by way of example only, with reference to certain embodiments and the attached Figures in which:

Figure 1 is a block diagram of a data generator according to an embodiment of the present invention;

Figure 2 is a block diagram of a processing strip within the data generator in Figure 1; and

Figure 3 is a flow chart of a method of generating a data slice according to a preferred embodiment of the present invention.

Similar references are used in different drawings to denote similar components.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Referring to Figures 1 to 3, a system for generation of large concatenated payloads according to an embodiment of the present invention is described. Figure 1 illustrates a data generator according to an embodiment of the present invention. The data generator 5 comprises a plurality of processing strips 7 and a data collection block 9. The processing strips may be implemented on one or more Application Specific Integrated Circuits (ASIC's) or other integrated circuits.

Each processing strip 7 generates and sends a data slice to the data collection block 9. According to a preferred embodiment, each processing strip generates SONET/SDH formatted data slices having a specific size. SONET/SDH data frame sizes can be measured in STS-1(Synchronous Transport Signal level 1) units. Therefore, in the preferred embodiment each processing strip 7 of the data generator 5 produces STS-n data slices, which are data slices comprising n STS-1 SONET building blocks pasted together. Accordingly, the processing strips 7 are also referred herein as STS-n strip. The data slices generated by the processing strips 7 are collected by the data collection block 9 into a data frame according to a pre-established collection order, such as the SONET transmission order in the case of a preferred embodiment. According to the present invention, the data frames generated may comprise concatenated payloads ranging from an STS-2c up to an STS-Nc, where N is limited only by the number of processing strips 7 included in the data generator 5. Advantageously, the generation of concatenated frames having a size larger than the size of a single data slice does not require any hardware overhead for communication among processing strips 7.

Figure 2 shows a block diagram of an STS-n processing strip 7. The processing strip 7 comprises a set of programable registers 11, a random number generator, a timing block 15 and a data slice assembler 17. In operation, the registers 11 receive a set of frame parameters indicating the desired format of the STS-n data slice to be generated from an operator through a microprocessor interface, for example. These values are sent to the data slice assembler 17 which interprets them to assemble data slices in the desired format. In addition to the register values, the data slice assembler 17 uses data from the random number generator 13 to generate payload data when appropriate, as detailed below, and signals from the timing block

15 to insert overhead bytes into the data slice assembled according to the requirements of the standard. The timing signals block receives as an input a SYNC 8K signal, which is an 8kHz reference indicating the phase of the frame to be generated.

According to the preferred embodiment, the set of registers **11** comprises a Large Concatenation Mode register **20**, a Pointer Value register **22**, p-stuff and n-stuff registers **24** and n Pointer State registers **26**. The Large concatenation Mode register **20** is a 1 bit register that indicates an ON or 'Fixed Pointer' state of the strip **7**, or an OFF or 'Variable Pointer' state of the strip. In the ON or Fixed Pointer state, the data slice generated by the strip **7** may be part of a larger concatenated frame which requires the stacking of multiple data slices. In the OFF or Variable Pointer state, the data slice generated by the strip 7 cannot be part of larger concatenations. In the Off state, the strip **7** may generate only up to STS-nc signals. The Pointer Value register **22** has the initial value of the SONET/SDH pointer. This value can be changed by performing pointer adjustments, p-stuff and n-stuff, which are programmed through their corresponding registers **24**. Each of the n Pointer State registers **26** corresponds to one of the STS-1 blocks to be incorporated in the STS-n data slice to be generated. Each Pointer state register **26** receives a 3-bit value that can represent one of the following five pointer states: a valid pointer 'V', a concatenation indication 'C', an alarm status indication 'AIS', an 'NDF'(new pointer) or 'OOR' (pointer out-of -range).

Referring also to Figure **3**, the generation of a data slice by the strip **7** occurs as follows. Initially, the data slice generation process is split **40** into a Variable Pointer procedure, when the Large Concatenation Mode is OFF and Fixed Pointer procedure, when the Large concatenation mode is ON. The Variable Pointer procedure comprises setting the pointer value to the value in the Pointer Value register, at **42**, making p-stuff and n-stuff adjustments at **44**, generating randomly all payload bytes at **46**. Additional overhead bytes for the data slice are generated based on timing signals from the Timing Signals block **15** at **48**. The Fixed Pointer procedure comprises setting the pointer value to a fixed predetermined value referred to as "fixed pointer value" at **50**. P-stuff and n-stuff values in the corresponding registers **26** are ignored, i.e. P-STUFF and N-STUFF values are set to 0, regardless of the values in the corresponding registers. For each STS-1 block in the data slice to be generated, the payload bytes are generated according to the associated pointer state indication, as follows: If the pointer state (PS) contains a concatenation indication 'C', the payload bytes

are generated such that the B3 value for the STS-1 block becomes a predetermined fixed B3 value (**52**). Since the B3 value for a SONET/SDH frame is an even parity check path BIP(Byte Interleaved Parity)-8 value calculated by XOR-in all payload bytes of the frame, the above setting is preferably made by randomly generating all payload bytes except one and setting the remaining one such that the all payload bytes XOR-ed are a fixed B3 predetermined value. The preferred embodiment sets B3=0 for all STS-1 blocks having a concatenation indication, thus the remaining byte is set to be exactly the XOR value of the randomly generated payload bytes. If the pointer state (PS) contains a valid pointer 'V', all payload bytes except B3 are generated randomly, **54**. The B3 byte takes the value of the B3 computed for the previous frame (**56**). Based on the payload bytes generated as such, the B3 value for the next frame is calculated (**58**). The generation of the STS-1 blocks for all other pointer states, 'AIS', 'NDF' and 'ODR', is done in any adequate mode, many of which are easily recognized by those skilled in the art. This cases are beyond the scope of the invention as in this cases the B3 does not contain a meaningful value. As in the Variable Pointer procedure, additional overhead bytes for the data slice are generated based on timing signals from the Timing Signals block **15** at **48**.

In the preferred embodiment the fixed pointer value assigned at **50** for the pointer value for each STS-1 block comprising a concatenation indication 'C' is the same for all data slices generated by processing strips 7 contributing to a concatenated frame. This feature, together with the setting of the B3 within each concatenated STS-1 block on a slice to a predetermined fixed value, allow strips **7** to contribute data slices to a larger concatenated payload without communication among strips **7**.

In addition, in the preferred embodiment, the data slice assembler **17** includes the capability to insert a Path Trace message. Pat Trace is a repetitive message which is inserted in the J1 byte over several frames, The Path Trace messgae is taken from an additional programmable register (not shown).

Numerous modifications, variations and adaptations may be made to the particular embodiments of the invention described in the documents attached herein, without departing from the scope of the invention, which is defined in the claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method for generating a data slice of a SONET/SDH type data frame, wherein the data slice has a plurality of STS-1 blocks, the method comprising:

a) reading a pointer state indication for one STS-1 block;

b) whenever the pointer state indication has a concatenation indication, generating payload bytes of the STS-1 block such that the B3 byte of the STS-1 block assumes a predetermined fixed value; and

c)repeating a) and b) for all STS-1 blocks within the data slice.

2. The method in claim 1 wherein the step of generating payload bytes comprises :

b1)selecting a first payload byte;

b2)randomly generating all payload bytes except said first payload byte; and

b3)assigning said first payload byte a value such that the B3 byte assumes a predetermined fixed B3 value;

3. The method in claim 1 wherein said predetermined fixed value is 0.

4. A method of generating a SONET/SDH frame, the method comprising:

A) initiating a set of programmable register values with frame parameters;

B) generating data slices comprising a plurality of STS-1 blocks based on said frame parameters, said data slice generation including:

whenever a large concatenation mode within said frame parameters assumes an ON state:

a) setting the pointer value to a predetermined fixed pointer value; and

b)generating payload bytes of every STS-1 block having a concatenation indication such that the B3 byte of the STS-1 block assumes a predetermined fixed B3 value;

C) collecting the data slices to generate a frame.

5. A data generator for generating SONET/SDH type data frames, the data generator comprising:

a plurality of processing strips for generating a plurality of associated data slices having STS-1 blocks, wherein each strip may operate in a large concatenation mode in which a fixed pointer value and a fixed B3 value is assumed for each STS-1 block within the data slice; and

a data collection block for collecting generated data slices into a data frame.

ABSTRACT

A data generator and a method for generating large concatenated SONET/SDH frame are provided. The method comprises initiating a set of programmable register values with frame parameters, generating data slices comprising a plurality of STS-1 blocks based on said frame parameters, and collecting the data slices to generate a frame. Whenever a large concatenation mode within said frame parameters assumes an ON state, the data slice generation includes, setting the pointer value to a predetermined fixed pointer value and generating payload bytes of every STS-1 block having a concatenation indication such that the B3 byte of the STS-1 block assumes a predetermined fixed B3 value.The data generator for generating SONET/SDH type data frames. The data generator comprises a plurality of processing strips for generating a plurality of associated data slices having STS-1 blocks. Each strip may operate in a large concatenation mode in which a fixed pointer value and a fixed B3 value is assumed for each STS-1 block within the data slice. A data collection block of the data generator collects generated data slices into a data frame. Among the advantages presented by the method and system of the preferred embodiments of the invention is the ability to generate arbitrary large concatenated payloads, without communication between processing strips of data generators.

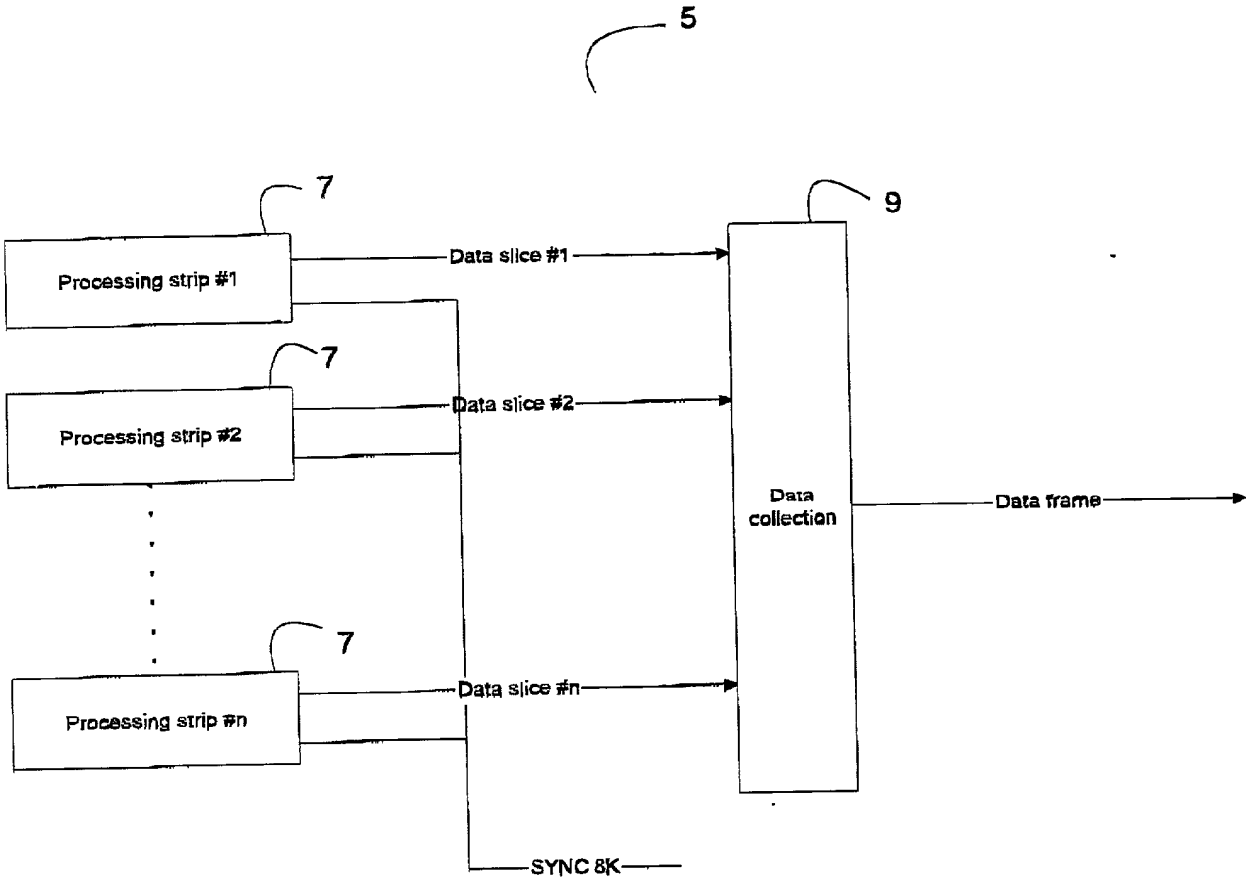
5
7
Processing strip #1
Data slice #1
9
7
Processing strip #2
Data slice #2
Data collection
Data frame
7
Processing strip #n
Data slice #n
SYNC 8K

FIG. 1

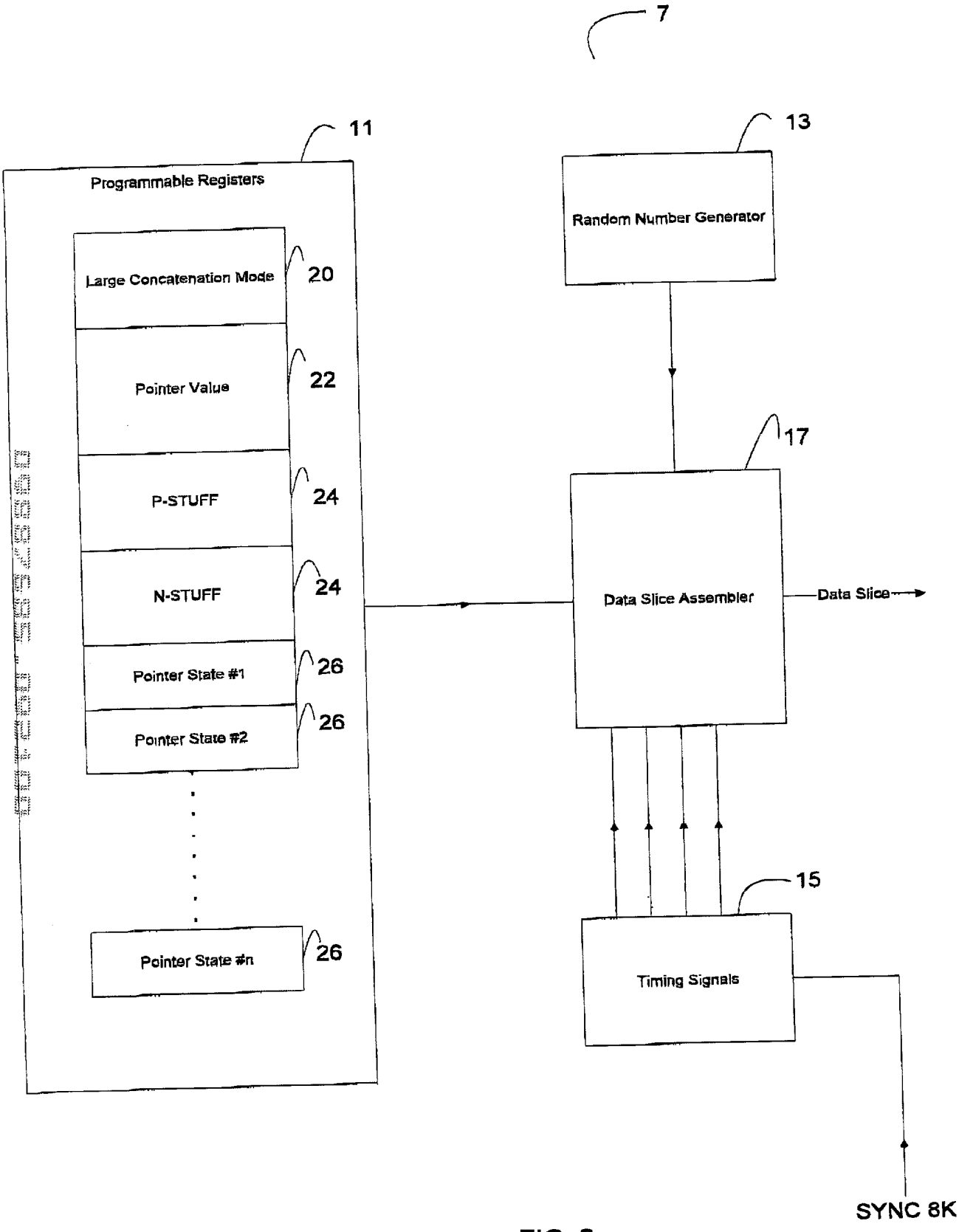
7
11
Programmable Registers
Large Concatenation Mode
20
Pointer Value
22
P-STUFF
24
N-STUFF
24
Pointer State #1
26
Pointer State #2
26
Pointer State #n
26
13
Random Number Generator
17
Data Slice Assembler
Data Slice
15
Timing Signals
SYNC 8K

FIG. 2

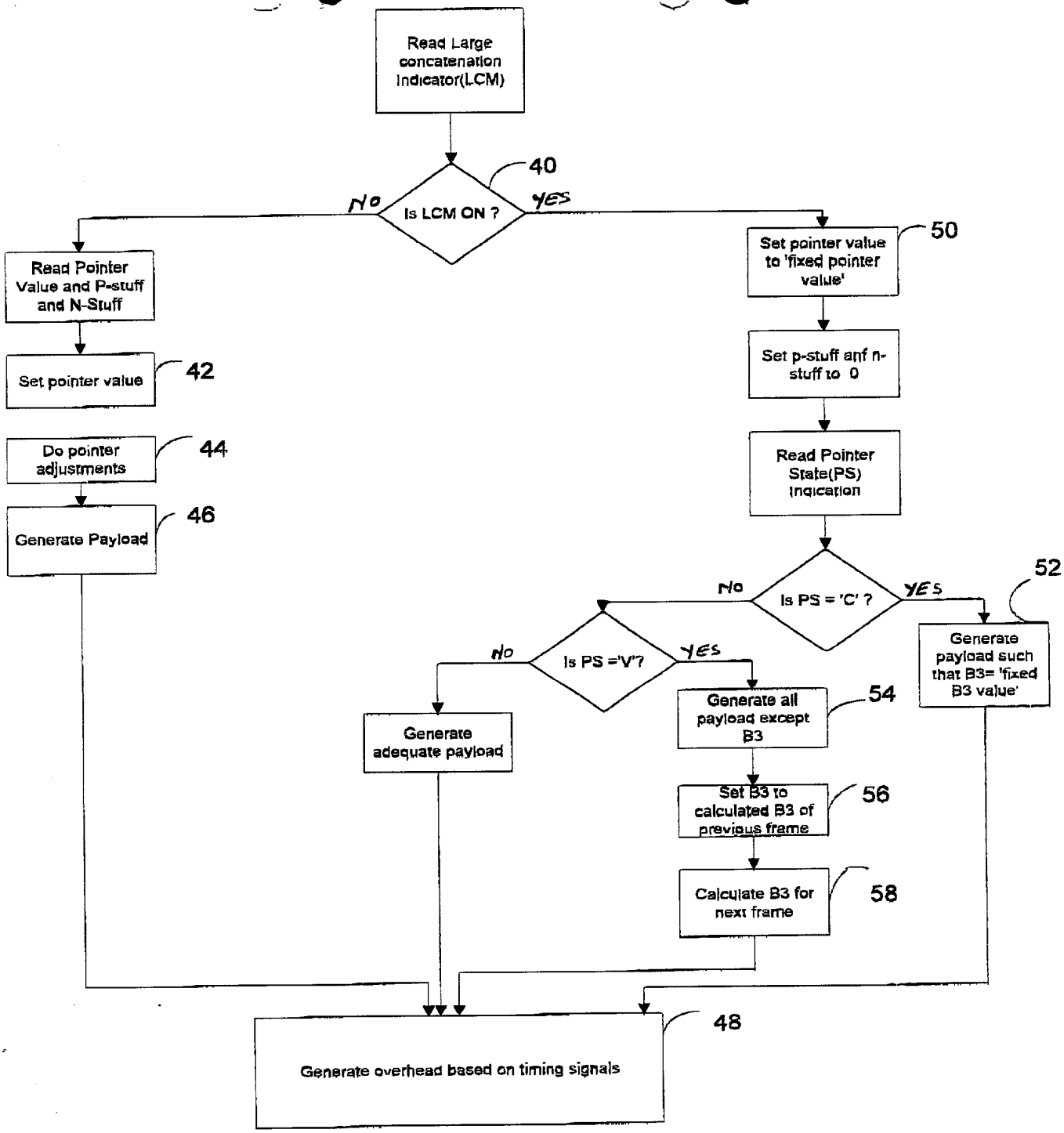
Read Large concatenation Indicator(LCM)
40
Is LCM ON ?
No
YES
Read Pointer Value and P-stuff and N-Stuff
Set pointer value
42
Do pointer adjustments
44
Generate Payload
46
Set pointer value to 'fixed pointer value'
50
Set p-stuff anf n-stuff to 0
Read Pointer State(PS) Indication
Is PS = 'C' ?
No
YES
52
Generate payload such that B3= 'fixed B3 value'
Is PS ='V'?
No
YES
Generate adequate payload
Generate all payload except B3
54
Set B3 to calculated B3 of previous frame
56
Calculate B3 for next frame
58
Generate overhead based on timing signals
48

FIG. 3

12212RO

COMBINED DECLARATION AND POWER OF ATTORNEY

ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: Original

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter which is claimed and for which a patent is sought on the invention entitled:

SYSTEM AND METHOD FOR GENERATION OF LARGE CONCATENATED PAYLOADS

SPECIFICATION IDENTIFICATION

the specification of which:

■ is attached hereto.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations. § 1.56(a).

PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

Country	Application No.	Date of Filing dd/mm/yyyy	Priority Claimed Under 37 USC 119

ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

Country	Application No.	Date of Filing

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status (patented, pending, abandoned)

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(List name(s) and registration number(s))*

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■ Attached as part of this declaration and power of attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

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DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(s)

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Case: 12212RO

ASSIGNMENT
NORTEL NETWORKS LIMITED

For value received, I (we) the undersigned, whose full post office address(es) is (are) adjacent my (our) name(s), hereby sell, assign and transfer to:

whose full post office address is: **NORTEL NETWORKS LIMITED**
World Trade Center of Montreal
380 St. Antoine Street West, 8th Floor
Montreal, Quebec
H2Y 3Y4 Canada

its successors, assigns and legal representatives, the entire right, title and interest, including priority rights, for all countries, in and to certain inventions relating to:

SYSTEM AND METHOD FOR GENERATION OF LARGE CONCATENATED PAYLOADS

set forth in an application for letters patent of the **UNITED STATES OF AMERICA**

executed concurrently herewith, and all rights and privileges under any and all letters patent that may be

granted for said inventions.

Witness Signature

L. J. McNaughton
Witness Name (print)

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